

Pediatric facial injuries: It's management

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ABSTRACT

Background: Facial injuries in children always present a challenge in respect of their diagnosis and management. Since these children are of a growing age every care should be taken so that later the overall growth pattern of the facial skeleton in these children is not jeopardized. **Purpose:** To access the most feasible method for the management of facial injuries in children without hampering the facial growth. **Materials and Methods:** Sixty child patients with facial trauma were selected randomly for this study. On the basis of examination and investigations a suitable management approach involving rest and observation, open or closed reduction and immobilization, trans-osseous (TO) wiring, mini bone plate fixation, splinting and replantation, elevation and fixation of zygoma, etc. were carried out. **Results and Conclusion:** In our study fall was the predominant cause for most of the facial injuries in children. There was a 1.09% incidence of facial injuries in children up to 16 years of age amongst the total patients. The age-wise distribution of the fracture amongst groups (I, II and III) was found to be 26.67%, 51.67% and 21.67% respectively. Male to female patient ratio was 3:1. The majority of the cases of facial injuries were seen in Group II patients (6-11 years) i.e. 51.67%. The mandibular fracture was found to be the most common fracture (0.60%) followed by dentoalveolar (0.27%), mandibular + midface (0.07) and midface (0.02%) fractures. Most of the mandibular fractures were found in the parasymphysis region. Simple fracture seems to be commonest in the mandible. Most of the mandibular and midface fractures in children were amenable to conservative therapies except a few which required surgical intervention.

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INTRODUCTION

Facial injuries in children always present a challenge in respect of their diagnosis and management. Since these children are of a growing age every care should be taken so that later the overall growth pattern of the facial skeleton in these children is not jeopardized.

The phenomenal increase in automotives on the road

has led to a tremendous rise in the number of road traffic accidents leading to facial injuries of which children are the most unfortunate victims. With the future morphological and anatomical changes in mind the management of these facial injury victims becomes a more complicated and arduous task for a surgeon.

However, rapid wound healing among children emerges as a promising sign to start with. The growth potential of children is much more as compared to adults and they also possess potential of self-correction of minor discrepancy in occlusion due to the remodeling process. Meanwhile mixed dentition presents a problem for intermaxillary fixation in child patients.

This study was undertaken keeping in mind the above fact, to know the incidence and pattern of facial injuries and to access the most feasible method for

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Figure 1: Mandibular parasymphysis fracture (patient with acrylic splint)



Figure 2: Postoperative occlusion after removal of splint



Figure 3: Patient with facial laceration



Figure 4: Postoperative photograph (six months after trauma)

the management of facial injuries in children without hampering the facial growth.

MATERIALS AND METHODS

The present study was conducted on 60 child patients with facial injuries attending the outpatient department of oral and maxillofacial surgery, U.P., King George University of Dental Sciences, Lucknow.

Detailed information consisting of age, sex, socioeconomic status, chief complaint, history of present illness, past medical history, dental history, duration of injury, etiological factors and associated injuries were recorded. After recording the history, a thorough clinical examination as well as radiological interpretation was done for every patient for establishing the diagnosis.

Clinical and investigational examination of the patients was done to see the status of intraoral or extra-oral swelling, facial lacerations or abrasions, bleeding,

involvement of the cerebrospinal fluid soft tissue injuries, facial deformity, ophthalmic involvement, degree of mouth opening, dentition, molar gagging, deviation of midline, bite-type, missing teeth, mid-palatal split, disturbed occlusion, fractured or avulsed teeth, retro-positioning of maxilla, infection, etc. The X-ray PA view, lateral oblique 30° of the mandible left or right, orthopantograph and occipitontal view of skull 30° of midface, and computerized tomography was ordered for complicated injuries.

On the basis of examination and investigations a suitable management approach involving rest and observation, open or closed reduction and immobilization, TO wiring, mini bone plate fixation, splinting and replantation, elevation and fixation of zygoma, etc. was carried out [Figures 1 - 12].

These patients were followed immediate postoperatively, at first week, third week, first month, second month, third month, and sixth month intervals. The information so collected was tabulated and subjected to analysis.



Figure 5: Radiograph showing fractures left body and right angle of mandible



Figure 6: Preoperative occlusion



Figure 7: Postoperative occlusion

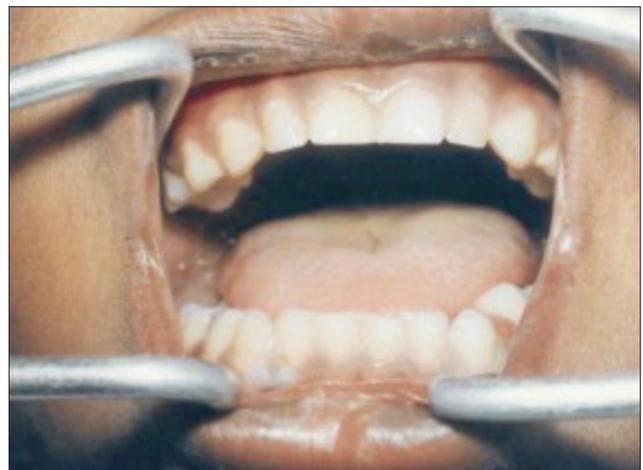


Figure 8: Postoperative mouth opening

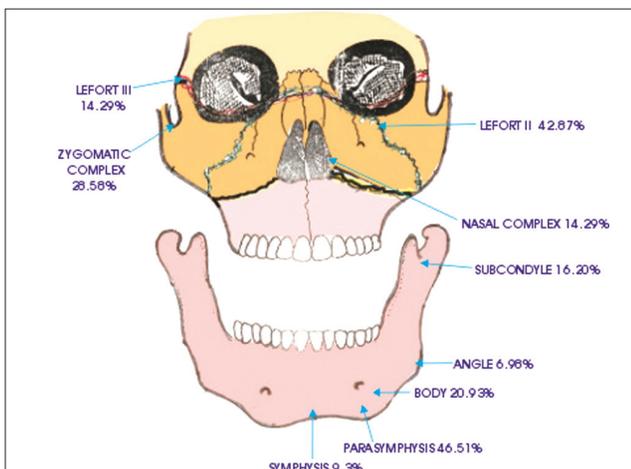


Figure 9: Incidence of facial fracture in children in this study

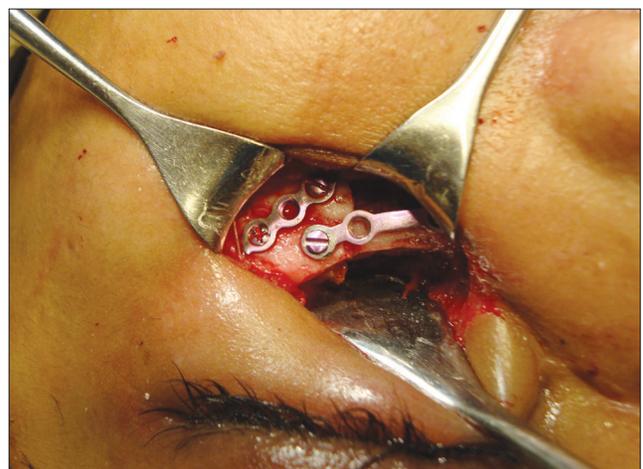


Figure 10: Miniplates used in one patient for infraorbital repair

RESULT

Out of the 5500 patients (2003-04) who reported to the outpatient department, only 60 children were

afflicted by facial injuries, the incidence being 1.09%. The incidence of mandibular fracture was found to be 0.60%, midface and mandible to be 0.07%, midface 0.01%, dentoalveolar 0.27% and laceration (0.13%) [Table 1].



Figure 11: Dentascan of patient



Figure 12: CT scan of patient

Child patients with facial fractures were divided into three groups based on dental status – Group I (0-5 years), Group II (6-11 years), and Group III (12-16 years). Group I consisted of 16 patients (26.67%), Group II 31 patients (51.67%) and Group III 13 patients (21.45%).

Among the etiological factors it was evident that fall (51.67%) was the major etiological factor responsible for facial injuries in children followed by road traffic accident (28.33%), sport (3.33%), hit by object resulted 10%, while miscellaneous and assaults were responsible for 3.33% of fractures, as shown in Table 2.

Associated injuries were found in four patients out of the 60 cases included in the study. In two patients there was associated injury in the upper arm, one patient had fracture of frontal bone and in another patient fracture of rib was present.

Out of a total of 60 child patients with facial injuries, 45 (75%) were male children as against 15 (25%) female, giving a male:female ratio of approximately 3:1 [Table 3]. It was seen that 26.09% mandible fractures were of greenstick type, 47.82% were of simple type and 26.09% fractures were compound type as shown in Table 4.

In Group I, 14.44% fractures occurred in the mandible and 6.67% fractures in the dentoalveolar region and 3.33% laceration. There was no midface + mandible and midface fracture found in these patients. In Group II, 5.56% fractures occurred in midface + mandible, 18.89% fractures in mandible, 13.33% in the dentoalveolar region, 6.67% lacerations and no fractures in midface. In Group III 2.22% fractures occurred in the midface, 4.44% fractures in midface + mandible, 12.22% fractures in the mandible, 7.78% fractures in the dentoalveolar region and 4.44% laceration. The maximum number of patients had fracture of the mandible in Group II, 18.89%, followed by mandible fractures in Group I (14.44%).

Table 1: Incidence of different injuries in 60 cases out of 5500 patients attending OPD

Injuries	No. of cases	Percentage
Mandible	33	0.6
Mandible + Midface	4	0.07
Midface	1	0.02
Dentoalveolar	15	0.27
Laceration	7	0.13

Table 2: Etiological distribution

Factor	Group I		Group II		Group III		Total	
	No.	%	No.	%	No.	%	No.	%
Fall	8	13.33	15	25.00	8	13.33	31	51.67
RTA	2	3.33	8	13.33	7	11.67	17	28.33
Sports	0	0	1	1.67	1	1.67	2	3.33
Hit by object	0	0	5	8.33	1	1.67	6	10.00
Assault	0	0	2	3.33	0	0	2	3.33
Miscellaneous	0	0	1	1.67	1	1.67	2	3.33
Total	10	16.66	32	53.33	18	30.00	60	100.00

$\chi^2 = 8.282$ (df=12), $P=0.601$ (NS)

Table 3: Sex-wise distribution of type/ pattern and number of different injuries

Site	Male		Female		Total	
	No.	%	No.	%	No.	%
Midface	1	1.67	-	-	1	1.67
Midface + Mandible	1	1.67	3	5.0	4	6.67
Mandible	25	41.67	8	13.33	33	55.0
Dentoalveolar	13	21.67	2	3.33	15	25.0
Laceration	5	8.33	2	3.33	7	11.67
Total	45	75.0	15	25.0	60	100.0

$\chi^2 = 6.813$ (df=4), $P=0.146$

Table 4: Types of mandibular fracture at various sites

Location	Green Stick		Simple		Compound	
	No.	%	No.	%	No.	%
Parasymphysis	5	10.87	10	21.74	5	10.87
Condyle	4	8.7	5	10.87	0	0
Angle	-	0	3	6.52	1	2.17
Body	2	4.35	3	6.52	4	8.7
Symphysis	1	2.17	1	2.17	2	4.35
Total	12	26.09	22	47.82	12	26.09

Total no. of mandibular fractures = 46

Various treatment modalities were carried out in the different age groups of patients. Group I – Four (6.67%) patients were kept under rest and observation, six (10%) required closed occlusal acrylic splint cemented onto the teeth, four (6.67%) required open occlusion and one (1.67%) required TO wiring and one (1.67%) required suturing. Group II – One patient (1.67%) was kept in rest and observation, three (5%) patients required splinting, one (1.67%) required replantation, one (1.67%) required extraction, three (5%) required arch bar wiring, seven (11.67%) closed occlusal acrylic splint cemented on the tooth, five (8.35%) open occlusal acrylic splint held by circummandibular wiring, one patient (1.67%) required open reduction and internal fixation, one (1.67%) case required TO wiring, two (3.33%) cases required dental wiring, one (1.67%) case carried out elevation of zygoma and miniplate fixation at fronto zygomatic suture with screw, four (6.67%) patients required suturing. Group III – Three (5%) patients required splinting, seven (11.67%) patients were treated with arch bar wiring, one (1.67%) with closed acrylic splint cemented on the tooth, one (1.67%) with open reduction and internal fixation, two (3.33%) patients required suturing [Table 5].

There was 91.89% improvement in occlusion postoperatively treated by both methods. Three cases had disturbed occlusion of which one case with cross bite i.e. 1.67% and two cases of open bite (3.33%). There was 91.67% improvement in shifting of midline postoperatively and one case having shifted midline that is 8.33% residual deformity. There was 100% improvement in mouth opening postoperatively treated by both the methods [Table 6].

It is evident that there was 100% improvement in nerve involvement postoperatively after the management of midface fractures. There was 100% improvement in ophthalmic involvement like diplopia, enophthalmos, epiphora, restricted ocular movement and lowering of ocular level in midface fracture cases, whereas antimongoloid slant and increased intercanthal distance did not improve postoperatively (100%). Postoperative complication was seen in a patient of unilateral parasymphysis fracture, in which there was anterior

open bite and in unilateral body fracture with fracture dentoalveolar there was anterior crossbite.

DISCUSSION

Fractures of the face in children pose problems which are not seen in the adult population. This study was undertaken to review the incidence, type of facial fractures in children and to formulate a comprehensive treatment modality. In our study the incidence of facial fractures in children up to 16 years of age was found to be 1.09%. This is in conformity with Rowe.^[1] According to Rowe the relative elasticity of bones in children and the facial skeleton in young children being less prominent than the cranium probably contribute to the low incidence of facial fracture in children.

We found a 0.1% incidence of facial fracture in children below five years of age. This low incidence of facial fracture in children below five years of age was also reported by several workers, MacLennan 1%,^[2] Hagan and Huelker 1.2%,^[3] Rowe and Killey 0.87%^[4] and Halazonitus 0.68%.^[5] This could be due to the fact that parental care in this age group prevents the children from sustaining severe injuries.

Fractures of the midface are extremely rare in children. In our study we found a 0.09% incidence of these fractures. This low incidence of middle third fractures was also propounded by Schuchardt 0.96%, MacLennan 0.25%,^[2] Rowe 0.2%.^[6] The facial skeleton in children is well protected by the cranium and in the case of maxilla, is not separated from the cranial base by well-pneumatized air sinuses and not weakened by the air sinus and further protected by the thick adipose layer

Table 6: Postoperative findings in mandibular fractures treated by both the methods

Preoperative finding	No. of patients	Postoperative improvement		Residual deformity	
		No.	%	No.	%
Disturbed occlusion	37	34	91.89	3	8.11
Reduced mouth opening	18	18	100.00	0	0
Shifting of midline	12	11	91.67	1	8.33

Table 5: Various treatment methods employed in different age groups

Group	Rest and observation	Splinting	Replantation	Extraction	Arch bar wiring	Acrylic splint (closed occlusal) cemented on the teeth	Acrylic splint open occlusal held by circummandibular wiring	Open reduction and internal fixation	Transosseous wiring	Dental wiring	Elevation of zygoma and mini bone plate fixation with screw at FZS	Suturing	Total No. %
I-No. (0-5yrs.)%	4 (6.67)	-	-	-	-	6 (10.0)	4 (6.67)	-	1 (1.67)	-	-	1 (1.67)	16 (26.67)
II-No. (6-11yrs.)%	1 (1.67)	3 (5.0)	1 (1.67)	1 (1.67)	3 (5.0)	7 (11.67)	5 (8.33)	1 (1.67)	1 (1.67)	2 (3.33)	1 (1.67)	4 (6.67)	30 (50.0)
III-No. (12-16yrs.)%	-	3 (5.0)	-	-	7 (11.67)	1 (1.67)	-	1 (1.67)	-	-	-	2 (3.33)	14 (23.33)

of soft tissue in young children. This is in conformity with the findings of Rowe.^[6] We noted that the number of midface fracture increases with age, this could be due to the fact that with maturation the paranasal sinuses grow and pneumatize making the midface more susceptible to fracture.

MacGraw and Cole^[7] reported that 42% of facial fractures were due to motor vehicle accidents. Posnick *et al.*,^[8] reported that 50% of the fractures resulted from road traffic accidents. We found that falls were the most common cause of fracture in children due to lack of control and judgment, followed by road traffic accidents due to increased automatization. Several authors also mentioned falls to be the common cause of facial fractures in children as studied by Carroll, Hill, Mason,^[9] Fortunato, Fielding and Guernsey,^[10] Hall,^[11] Khalil and Shaladi.

Male children were approximately thrice as frequently affected as female children, the male to female ratio being 3:1. This is probably due to the higher level of physical activity among boys. A similar male to female ratio of 3:1 was also reported by Hall.^[11] Among the types of mandibular fractures, the simple fracture was the most common fracture reported during this study (47.82%). Mandibular fractures were the most common (55.46%) fractures reported in our study. The reason for this being that the position of the mandible is more vulnerable to fracture than the midface as suggested by McCoy *et al* Hall^[11] and Kaban *et al.*^[12]

Posnick *et al.*,^[8] reported that the condyle was the most common site of mandibular fracture, in contradiction to this, we in our study found that parasymphysis was most commonly involved. It may be because of the presence of permanent tooth buds in the pediatric mandible presenting high tooth to bone ratio, bony thinness and anatomical curvature of mandible encourages fractures through the developing tooth crypt in this region. We noted that dentoalveolar fractures involved 27.78% of the total fractures in the anterior part of the mandible and maxilla. Since the upper incisor region is prone to injuries, most of the dentoalveolar fractures in our cases involved the anterior region of maxilla as compared to the mandible.

Associated injuries were seen in only four patients out of a total of 60 patients. This is contrary to the Posnick *et al.*,^[8] reports of 33% associated injuries. This difference could be due to the difference in etiological factors as we found that the majority of the fractures occurred due to a fall, whereas in these cases, road traffic accident was the main cause of fracture, in which the potential of multiple system injury is more. Kaban^[13] stated that the most common treatment for condylar fracture

in children continues to be rest, a liquid to soft diet in cases where occlusion is not disturbed or a short immobilization for 7-10 days in case of malocclusion. In our study we followed the same procedure for treating the condylar fractures followed by several months of active jaw immobilization. We obtained a morphologically and functionally acceptable condyle without any complication, supporting the fact that the conservative method is best suited for condylar fractures.

In our study undisplaced mandibular fractures or fractures with minimal displacement without occlusion disturbance were managed conservatively. All of them healed with good bony union, and had no complication. This is in accordance with the study by Rowe^[6] and Kaban.^[13] Open occlusal acrylic splints were transfixed with circummandibular wiring in mandibular fracture cases in Group I and Group II patients. The status of dentition in these age groups *i.e.* mixed dentition, partially erupted permanent teeth resulted in difficulty in using the arch bar. The above observation coincides with the observation of McCoy *et al.*,^[14] Rowe,^[6] Khosla and Boren,^[15] and Keniry^[16] and Waite.^[17] All the cases in our study revealed a satisfactory postoperative result. Fractures treated with closed occlusal acrylic splints in Group I and Group II patients showed satisfactory union. Fifty percent of the dentoalveolar fractures were stabilized with arch bar. This was in compliance with the work of MacLennan^[18] and McCoy *et al.*,^[14] A bilateral parasymphysis with unilateral subcondylar fractures was treated by intermaxillary fixation with the elastic anchored to the upper and lower arch bar.

TO wiring was employed in two cases of displaced angle fractures. All of them healed with good bony union without any complications. TO wiring in displaced body and angle fracture of the mandible was suggested by Rowe, Ramba, Row and Killey, Graham and Peltier.^[19] Intermaxillary fixation with the help of elastic anchored to the upper arch bar and lower splint for about 7-10 days gave additional stabilization in a few cases. Replantation of avulsed permanent incisors was carried out in cases of dentoalveolar fracture and immobilization was maintained by arch bar in one and acrylic splint cemented on the teeth in another. Five cases however required symptomatic therapy to relieve pain and edema. They included a unilateral subcondylar fracture and four cases of dentoalveolar fractures. In one case a vertically fractured upper permanent central incisor was extracted as it could not be retained as suggested by Rowe and Williams.^[20]

Posnick JC^[21] suggested the use of minibone plate with screws in midface fracture in children. We treated our patients of unilateral zygomatic complex fracture with

unilateral Lefort III fractures, by open reduction and elevation of zygoma and minibone plate fixation, with screw frontozygomatic suture. We observed a low incidence of facial fracture in children, specially the midface, which was found only in the older two age groups i.e. Group II and Group III. Mandibular fracture was the most common and parasymphysis was the most commonly involved site. A fall was the most common etiological factor responsible for fracture of the facial skeleton in children.^[22-24] Dentoalveolar and most of the mandibular fractures were amenable to conservative therapies and a few mandibular fractures required surgical intervention.

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